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(54) Title: A METHOD OF APPLYING TREATMENT CHEMICALS TO A FIBER-BASED PLANAR PRODUCT VIA A REVOLVING BELT AND PLANAR PRODUCTS MADE USING SAID METHOD

(57) Abstract: The present invention relates to a method of applying treatment chemicals to a fiber-based planar product, particularly tissue, said method comprising the steps of: a) applying a treatment composition containing the treatment chemicals to a revolving belt (1) and b) bringing the revolving belt (1) into contact with the moving fiber-based planar product (3), thereby transferring the treatment composition from the revolving belt (1) via the contact surface to the moving fiber-based planar product (3), as well as an apparatus suitable for performing this method, comprising: at least one application means (4, 5) for applying treatment compositions to a revolving belt (1), and the revolving belt (1) that is in contact with moving fiber-based planar product (3) via a contact surface and transfers the applied treatment composition via this contact surface to the moving fiber-based planar product (3).

A METHOD OF APPLYING TREATMENT CHEMICALS TO A FIBER-BASED PLANAR PRODUCT VIA A REVOLVING BELT AND PLANAR PRODUCTS MADE USING SAID METHOD

[Specification]

The present invention relates to a method of applying treatment chemicals to a fiber-based planar product, particularly tissue, an apparatus for performing the method and the planar products made using same, particularly tissue products. Within the framework of the present invention, the term "tissue" especially includes "tissue paper" or "raw tissue", as is normally produced as a one-ply tissue web in the tissue (paper) machine, as well as including multiply (intermediate) products, e.g. in the form of multiply doubled webs or in the form of master rolls for further processing and ready-made one-ply and multiply tissue products such as paper handkerchiefs, facials, toilet paper, household towels such as kitchen towels, hand towels and other wipes etc.

[Prior art]

Based on the underlying correspondence of the production processes (wet laying), "tissue" production is counted among the paper making techniques. The production of tissue, or more accurately, raw tissue if the one-ply (intermediate) product manufactured on a special-purpose paper machine of the tissue or tissue paper machine is meant, is delimited from paper production as a result of the extremely low basis weight of normally less 65, more often less than 40 g/m^2 and as a result of the much higher tensile energy absorption index as compared to paper. The tensile energy absorption index is arrived at by relating the tensile energy absorption to the test sample volume before inspection (length, width, thickness of sample between the clamps before tensile load).

Paper and tissue paper also differ in general with regard to the modulus of elasticity that characterizes the stress-strain properties of these planar products as a material parameter, depending on the production conditions, raw materials used and chemical additives.

A tissue paper's high tensile energy absorption index results from the outer and/or inner creping. The former is produced by compression of the tissue paper web adhering to a dry cylinder as a result of the action of a crepe doctor or in the latter instance as a result of a difference in speed between two successive screens or e.g. between a sheet-forming screen and a so-called fabric or between two fabrics.

When applying the through air drying (TAD) technique for the production of raw tissue and the usual double-screen sheet formation in c-wrap configuration, for example, the so-called inner sheet-forming screen can thus be operated at a speed that is up to 40% faster than that of the next fabric or that of the subsequent felt, the initially formed and already pre-drained paper web being transferred to the next TAD fabric. This causes the still moist and as a result plastically deformable paper web to be internally broken up by compression and shearing, thereby rendering it more stretchable under load than a paper that has undergone neither "internal" nor external creping.

This transfer of a still plastically deformable paper web at a differential speed that simultaneously takes effect may also be brought about in other embodiments between a transfer fabric and the so-called TAD imprinting fabric or between two transfer fabrics.

German has adopted the English-language term "fabric" to designate paper machine covers that exhibit a screen-like fabric structure in which synthetic threads are used as a thread material instead of metal wires.

Most of the functional properties typical of tissue and tissue products result from the high tensile energy absorption index (see German standards DIN EN 12625-4 and DIN EN 12625-5). An example is represented by tissue products for hygienic applications (hygiene products, particularly hygiene paper products) which are e.g. used in personal grooming and hygiene, the household sector, industry, the institutional field in a very wide variety of cleaning processes. They are used to absorb fluids, for decorative purposes, for packaging or even just as supporting material, as is common for example in medical practices or in hospitals. In terms of their wide variety, hygiene paper products are now considered to be everyday products.

Hygiene paper primarily includes all kinds of dry-creped tissue paper, as well as wet-creped paper.

The one-ply intermediate products originating from the paper machine and made of lightweight, i.e. low basis weight paper usually dry-creped on a yankee cylinder by means of a crepe doctor are generally described as "tissue paper" or more accurately raw tissue paper. The one-ply raw tissue may be built up of one or a plurality of layers respectively.

All one-ply or multiply final products made of raw tissue and tailored to the end user's needs, i.e. fabricated with a wide variety of requirements in mind, are known as "tissue products".

Typical properties of tissue paper include the ready ability to absorb tensile stress energy, their drapability, good textile-like flexibility, properties which are frequently referred to as bulk (crumple) softness, a high surface softness, a high specific volume with a perceptible thickness, as high a liquid absorbency as possible and, depending on the application, a suitable wet and dry strength

as well as an interesting visual appearance of the outer product surface. These properties allow tissue paper to be processed into tissue products (tissue paper products) and are then available to end users in a wide variety of forms and fabrication, for example as wipes, towels, household towels, particularly as kitchen towels, sanitary products (e.g. toilet paper), paper handkerchiefs, cosmetic tissues (facials) or serviettes/napkins.

Depending on the particular application, varied and to an extent conflicting properties are frequently needed for the successful use of tissue products in their extremely broad range of applications.

For this purpose, the tissue is frequently provided with substances, additives, auxiliary substances and other treatment chemicals.

In accordance with the invention, this term will also cover any substance or blends of substances generally referred to as treatment chemicals and normally applied to the tissue after the drying and creping step on the yankee cylinder.

Treatment chemicals may have an influence on physical properties, e.g. softness, particularly bulk softness, strength in the dry and wet states, rate of absorption of liquids, particularly that of water or oil, or the structural strength of the tissue/tissue product itself, and/or they may contribute to their varying use, e.g. in the field of skin care and protection, healthcare, etc. "Lotions" are also particularly referred to in the latter case.

Household towels for example, particularly kitchen towels and to an even greater extent paper towels, require strength, especially in the wet state, and high suction capacity so as to satisfy consumer demands. In the case of toilet paper, a combination of dry strength plus good softness is more likely

to determine suitability in practice and acceptance among consumers. In the case of other tissue products such as handkerchiefs or facial wipes, surface softness and excellent suppleness are predominant properties which, in addition to strength, define the serviceability of these products.

Cosmetic components contained in the product, though particularly present on its outer surfaces also play an important part in the latter tissue products. Such cosmetic components include, inter alia, perfumes, moisturizers, skin care agents, healthcare substances such as panthenol or the active camomile ingredient bisabolol.

It is important in the case of cosmetic components to achieve an optimum transfer of the components such as care agents or moisturizers from the tissue product to the skin - optimum in the sense of an adequate quantity of such components - so as to promote the desired effect. High amounts of the cosmetic substances to be applied to the tissue are necessary for this purpose. On the other hand, the tissue itself must not feel unpleasant or e.g. leave behind a wet feeling on the skin.

Manufacturers of tissue products are therefore especially faced with the challenge of achieving a particular balance between the various, frequently contradictory parameters in order to use this balance to obtain the optimum combinations of features required by consumers for the desired final products. The article entitled "*Weichheit und Weichmachung von Hygiene-Tissue*" in the *Wochenblatt für Papierfabrikation*, No. 11/12, 1988, pages 435 et seq., describes in detail the properties of hygiene tissue and discusses their importance to tissue products in different applications.

Thus, one of the principal consumer demands to be met by manufacturers is a general improvement in softness in all areas of tissue products. Properties such as the softness of a tissue product are defined in terms of their basic design

by the production process, particularly by preliminary TAD and the choice of raw and auxiliary materials.

Softness is an important property of tissue products such as handkerchiefs, cosmetic wipes, toilet paper, serviettes/napkins, not to mention hand or kitchen towels, and it describes a characteristic tactile sensation caused by the tissue product upon contact with the skin.

Although the term "softness" is generally comprehensible, it is extremely difficult to define because there is no physical method of determination and consequently no recognized industrial standard for the classification of different degrees of softness.

To be able to detect softness at least semi-quantitatively, softness is determined in practice by means of a subjective method. To do so, use is made of a "panel test" in which several trained test persons give a comparative opinion.

In simplified terms, softness can be subdivided into its main characteristics, surface softness and bulk softness.

Surface softness describes the feeling perceived when e.g. one's fingertips move lightly over the surface of the sheet of tissue. Bulk softness is defined as the sensory impression of the resistance to mechanical deformation that is produced by a tissue or tissue product manually deformed by crumpling or folding and/or by compression during the process of deformation.

The application of the aforementioned treatment chemicals with which e.g. the desired softness characteristics or other properties are to be achieved is brought about in the prior art by different roll and spray application techniques. Other methods include impregnation techniques.

WO 94/05857 describes a method of applying a chemical paper-making additive to a dry tissue paper mat (tissue paper nonwoven fabric, raw tissue). The application technique is characterized by the following steps: provision of a dry tissue paper mat, dilution of a chemical paper-making additive using a suitable solvent to form a diluted chemical solution, the application of this diluted chemical solution to a heated transfer surface, partial evaporation of the solvent through the transfer surface to form a film that contains this paper-making additive and the transfer of this film from the heated transfer surface to the surface of the tissue mat.

EP-A-03 47 177 relates to a method of making soft tissue paper comprising the following steps: forming sheets from an aqueous suspension of cellulose fibers to form a mat, application of a sufficient amount of water-soluble non-cationic surfactant and drying and creping the mat, this tissue paper exhibiting a basis weight of 10 to 65 g/m^2 and a density of less than 0.6 g/m^3.

The treatment solution can therefore be added both in the wet section of a tissue paper machine (wadding machine), at the end of the screen section, before or inside the press section (mechanical drainage), i.e. in the case of solid contents between 20 and 50 %, and in the dry section disposed after the press section in the case of solid contents of 40 to 97 % fibrous dry weight.

The prior art is represented by feed sites on the transfer screen/belt, e.g. ahead of mat transfer in a TAD layout, and the supply to the moist fibrous mat after its transfer to the transport (dry) felt before the press or presses in a conventional single-felt or double-felt tissue machine.

The supply of treatment compositions by spray application onto the yankee cylinder is also known in the prior art.

The addition of the treatment chemicals within the tissue making machine is brought about by spray application onto the pope roller to produce a film and subsequently to transfer it to the tissue web during rolling up. The already creped "tissue web" usually still exhibits a residual temperature of between 20°C and about 70°C as a result of the preceding drying process on the yankee cylinder, which benefits the distribution of treatment chemicals and their penetration of the raw tissue.

In addition to spray application via a nozzle bar, the use of centrifugal rotors or brush units is possible. Application may also be effected directly onto the tissue paper web.

Addition of the treatment chemicals, within a so-called doubling machine or within the processing machine, to the outer plies of the multiply doubled web before or during calibration/smoothing is generally preferred.

Application of the treatment chemicals to the outer plies of the web frequently takes place within the processing machine, the web being guided in multiply fashion by use of a plurality of unwindings in the processing machine or being previously doubled in multiply fashion.

WO 98/41687 describes a method of making tissue products of the aforementioned kind, this method being characterized by the fact that a composition of the above type is applied to the fibrous mat or tissue web within the screen section, press section, TAD section, on the yankee cylinder and/or dry section, i.e. at a fibrous material density of 20 to 97 %, relative to the web's dry fibrous weight, in an amount of 0.1 to 40 %, preferably 1 to 20 %, continuously or discontinuously on or within the web and the web may undergo post-smoothing after application.

An alternative embodiment mentioned in this document relates to a method of making tissue products, this method being characterized by the fact that a composition of the above type is applied to the fibrous mat or tissue web after the dry section on the wadding machine, doubling machine and/or in the automatic processor in an amount of 0.1 to 40 wt.%, preferably 1 to 20 wt.%, continuously or discontinuously on or within the web and the web may undergo post-smoothing after application.

The known techniques suffer from various disadvantages that lead to an impairment of the tissue properties. The pressure exerted on the tissue, e.g. when using roller application techniques to apply the treatment chemicals, particularly during follow-up smoothing of the product treated with a treatment composition, causes the occurrence of undesirable mechanical effects upon the tissue. The tissue is compressed, thereby decreasing e.g. its thickness (bulk), which consumers usually feel to be detrimental e.g. in the case of a paper handkerchief. Such a subjective impression on the user's part in the example of a thickness that is perceived to be detrimental may in turn wreck any objective improvement e.g. in surface softness, because consumers refuse to buy such a product. This is a problem that is particularly faced by multiply tissue products.

Roller or spray-on application is limited by the viscosity of the lotion to be applied. Highly viscous and/or fatty lotions can be applied to paper by means of a spray technique only with extreme difficulty or not at all. It is therefore often necessary to use e.g. water or organic solvents to dilute or refine the treatment compositions to be applied, entailing another process step in which the employed solvent has to be removed from the fiber-based planar product, particularly tissue, once more.

The distribution of the treatment chemicals within the tissue over the surface of the paper web (sheet of paper) and the distribution in the z direction, i.e. perpendicular to the surface of the paper web optionally over all the plies of the tissue product, depends on various factors.

The properties exhibited by the treatment compositions, particularly their viscosity and fat content here, play an important part in the depth of penetration.

The known application techniques such as spray application or the various roller application techniques entail only inadequate control of the distribution of treatment chemicals, particularly in the z direction, i.e. perpendicular to the surface of the tissue. This problem arises with particular clarity in the case of multiply tissue fabrics.

The treatment chemicals applied to the surface penetrate into the tissue only to a slight extent, and often remain only on the top-most layer. Only a smaller part passes to the inner region. This means a major disadvantage precisely in the case of tissue products that contain softness-enhancing treatment compositions (sometimes also known as "softness-promoting lotions") because this treatment composition is applied to the inner plies of the multiply tissue product only to an unsatisfactory degree. The desired effect of an improvement in bulk softness as a result of treating (applying lotion to) the tissue product can develop in this way only to an unsatisfactory degree.

On the other hand, the problem with tissue products that contain cosmetic treatment chemicals (sometimes also known as "cosmetic lotions") is the even distribution of the cosmetic components of the treatment composition on the external surfaces of the treated tissue product's outer plies.

This is so because it is necessary, on the one hand, to apply a large amount of cosmetic components in order to ensure the desired action of the cosmetic substances upon transferral to the user's skin (healthcare) when using the tissue product. It is also necessary to guarantee the evenness of the amount of treatment composition applied to the external surfaces of the tissue product's outer plies for legal reasons, e.g. on grounds of competition law. Because the cosmetic components of a lotion simultaneously represent very significant cost factors, it is likewise necessary, for reasons of economy, to control within narrow limits the amount of such components applied.

This problem of distributing the treatment chemicals that include e.g. emollients and/or cosmetic treatment compositions plays an important part in the case of tissues.

Roller or spray-on application is limited by the viscosity of the lotion to be applied. Highly viscous or fatty lotions can be applied to paper only with extreme difficulty.

[Object of the invention]

It is therefore the present invention's object to make available a method and apparatus that enable a considerably improved application of treatment chemicals to tissue. A further object of the invention is to provide a fiber-based planar product, particularly tissue, exhibiting an improved distribution of treatment chemicals.

This object is solved by a method of applying treatment chemicals to a fiber-based planar product, particularly tissue, such a method comprising the steps of

a) applying a treatment composition containing the treatment chemicals to a revolving belt,

b) bringing the revolving belt into contact with the moving fiber-based planar product, thereby transferring the treatment composition from the revolving belt via the contact surface to the fiber-based planar product.

The invention's preferred embodiments are reproduced in the dependent claims. The embodiments reproduced below by way of example as regards tissue also apply to other fiber-based planar products. The term "fiber-based planar product", as used here, stands for planar products made from fibers (particularly cellulose-containing fibers, such as pulp), e.g. nonwovens or tissue, tissue representing a particularly preferred embodiment.

In accordance with the invention, it is preferable for another revolving belt in contact with the tissue to be provided on that side of the tissue which is opposite the first belt. Treatment compositions can also be applied to this second belt; they are then applied to the tissue via the contact surface of the second belt. The treatment compositions transferred using the second belt may differ from the treatment compositions transferred using the first belt. This embodiment makes it possible to bestow different properties upon the top and bottom of the tissue.

The direction of travel (or machine direction) of the belt contact surface usually coincides with the direction of travel of the tissue. The first belt and optionally the second belt preferably have approximately the same speed as the tissue.

Elastomeric plastics (such as rubber) exhibiting the necessary strength values are particularly suitable as belt material; such elastomers may optionally be reinforced (e.g. by fibers).

Before reapplying the treatment composition, e.g. by an immersion bath, the belts can optionally be cleaned and, if necessary, dried.

The treatment compositions are preferably applied to the belts by means of spray application, e.g. via a nozzle bar, centrifugal rotors or brush units, or by means of roller application. If the intention is to apply a plurality of treatment chemicals to the tissue, they can be supplied e.g. as a blend via an application means, supplied to a first and/or second belt via a plurality of application means or a plurality of belts can be provided in succession in the machine direction (MD). The tissue can also be guided past the same belt several times in order to apply the same or different treatment compositions successively. Other versions in terms of configuration and number of belts and in terms of the configuration of the application means (e.g. spray applications and/or roller applications) are likewise covered by the invention.

To transfer the treatment compositions to the tissue more effectively and/or to promote penetration of the treatment composition into the tissue, the tissue may be heated before, during or after application of the treatment composition. The first and/or second belt can alternatively be heated. This may be brought about e.g. by supplying heated air. Another possible way of controlling the penetration of the treatment composition into the tissue is to vary the contact surface.

The treatment composition (e.g. a cosmetic lotion) can be applied in a structured manner on one or both external sides, i.e. it is possible to provide free surfaces or recesses within which no treatment composition is applied. As a result, the degree of absorption is maintained as far as possible.

The treatment composition may comprise a single treatment chemical or a blend of at least two treatment chemicals. This composition may also contain compounds that have no influence or only a slight influence on the properties of the treated planar product, particularly tissue, e.g. solvents (such as water and/or alcohol), auxiliary substances and/or additives. It may therefore be present e.g. as an aqueous solution or dispersion (e.g. suspension or emulsion) or comprise one or more treatment chemicals (water not included). Water may, however, also be an important active constituent of the treatment composition, particularly in cosmetic lotions intended to achieve a pleasant moist sensation on the skin. Water is then preferably used in combination with hygroscopic compounds, e.g. the polyhydroxy compounds described below. Depending on the treatment composition's function, the proportion of optionally present solvents (including water) in the composition is preferably less than 60 wt.%, with greater preference on less than 30 wt.%, even greater preference on less than 10 wt.%, particularly less than 5 wt.%, each relative to the total weight of the composition.

The treatment chemical(s) may be selected from the following compound classes or compounds.

Agents for skin care and protection, so-called cosmetic lotions such as

- moisturizers, such as substituents for the skin's natural moisturizing factor (NMF) that contain e.g. cleavage products of collagen, glycerol etc.;
- skin care agents, e.g. long-chain fatty acid esters (like sorbitan fatty acid ester or Cetiol®), lanolin or derivatives thereof;
- fragrances, e.g. natural, naturally identical or artificial perfumes; and/or
- active cosmetic ingredients like D-panthenol or the active camomile ingredient α-bisabolol or

agents exhibiting other functions, e.g.

- strength-boosting agents, particularly wet-strength agents like epichlorohydrin resins or crosslinked polyalkylene amines,
- agents that promote the softness (e.g. bulk softness or surface softness) of the planar product, particularly the tissue; e.g. a polyhydroxy compound (e.g. ethylene glycol, propylene glycol, a liquid polyethylene glycol (derivative), a liquid polypropylene glycol (derivative) and/or glycerol), also quaternary ammonium compounds as described e.g. in US 5,312,522 or 5,397,435 and the prior art cited therein, optionally in combination with the polyhydroxy compounds described in both these documents; or a poly(siloxane), particularly the (poly)siloxanes described in EP-A-347 153 and EP-A-347 154,
- surfactants used e.g. as absorption rate control agents, e.g. long-chain quaternary ammonium compounds that may also exhibit softness-promoting action,
- waxes, oils, and/or
- inorganic or organic pigments or dyes.

A preferred basic composition for improving softness, particularly bulk softness, comprises the following recipe:

glycerol:	40 - 45 %
propylene glycol:	28 - 30 %
linden extract:	2.5 - 3.5 %
water	up to 100 %

The total amount of nonvolatile treatment chemical(s) applied in the first and second surface areas of the planar product, particularly tissue, is preferably 0.01 to 50 wt.%, with greater preference on 0.5 - 45 wt.% and even greater preference on 0.75 - 40 wt.%, relative to the weight of the untreated oven-dried planar product, particularly tissue (oven-dried being understood in accordance with German standard DIN EN 20638). Even greater preference is given to values of 1-35 wt.%, particularly 2-30 wt.% (what is

considered to be volatile is any component that volatilizes upon further processing of the planar product, especially tissue, e.g. solvent such as water, unless it is intended to remain in the composition, e.g. a cosmetic lotion.).

The apparatus for applying treatment chemicals to tissue comprises: at least one application means for applying treatment compositions containing the treatment chemicals to a revolving belt, and the revolving belt that is in contact with moving tissue via a contact surface and transfers the applied treatment composition to the moving tissue via this contact surface.

The apparatus according to the invention may also have a second revolving belt on that side of the tissue which is opposite the belt, the second belt also being provided with at least one application means with which a treatment composition can be applied to the second belt, the treatment composition being transferred to the tissue via the contact surface of the belt with the tissue.

The speeds of the first belt and/or second belt and of the moving tissue are preferably approximately equal. It is also preferable for the direction of travel of the belts, on whichever side faces the tissue, and of the tissue to be equal within the apparatus.

In another preferred embodiment, at least one application means of the apparatus according to the invention comprises at least one spray means, e.g. a nozzle bar, centrifugal rotors or brush units, and/or at least one roller. The one or more application means may be present in various configurations and combinations.

The apparatus according to the invention preferably comprises one or more heating means for at least one of the revolving belts.

It may also be advantageous for at least one of the belts to be structured in order to lend the manufactured tissue a surface structure.

The method of making a tissue product according to the invention comprises one or more of the procedural steps described above. Other procedural steps that may be necessary, depending on the tissue product, are known to specialists and have already been mentioned to an extent.

The present invention also relates to a fiber-based planar product that contains a treatment composition; this product can be obtained according to a method that comprises the steps described above.

The term "tissue" as defined by the present invention is understood as any kind of creped paper made from an aqueous dispersion and having a basis weight range of usually between 10 and 65 g/m^2. In accordance with the invention, the term "tissue" covers both

- the entire range of raw creped paper, also known as "raw tissue", particularly the range of dry-creped raw tissue paper, regardless of whether they are single-layer or multilayer,
- and any single-layer or multilayer end products made of this creped raw paper.

"Raw tissue" is usually made as a one-ply tissue web in the tissue (paper) machine or as an optionally multiply (intermediate) product, e.g. in the form of multiply doubled webs or in the form of master rolls for further processing. The term "layers" refers to a change in chemical and/or physical properties within a tissue ply; such a change may be caused e.g. by a different fiber composition. In contrast to plies, layers usually cannot be separated from one another.

The final product is preferably

- a cleaning wipe, e.g. wiping paper, a windscreen cleaning wipe, a cleaning wipe for industrial applications, a towel or a cleaning wipe for household use, e.g. kitchen paper;
- a sanitary product, e.g. toilet paper (also moist);
- a paper handkerchief (also moist);
- a household towel, e.g. kitchen towels;
- a towel;
- a tissue for facial use, e.g. a makeup removal tissue (facial) or cosmetic tissue,
- a serviette/napkin,
- bed linen;
- a garment, e.g. disposable apparel for hospitals or kitchen staff.

Particularly preferred tissue products are handkerchiefs, tissues for facial use, sanitary products (e.g. toilet paper) and towels in which the application of cosmetic treatment compositions and/or treatment compositions that convey softness (lotions) plays a part.

The term tissue paper must also be regarded independently of the fibrous raw material to be used, particularly irrespective of whether the fibrous raw material is made solely or mainly from natural pulps e.g. according to the sulfate or sulfite process, or is used in a mixture with chemothermomechanical wood pulps (e.g. CTMP, or HTCMP), or whether the fibrous raw material used comes from a secondary fiber refinement process and whether the fibrous raw material needed to make tissue therefore completely or partially comprises "recycled fibers".

To distinguish from nonwovens, it should be noted that although the predominant use of natural (cellulose-containing), i.e. vegetable, pulp fibers broken up in a manner suitable for paper making is typical of tissue paper manufacturing, a proportional use by refinement of modified

pulp fibers in a range of 10 to 50 %, relative to the total weight of the fibers, or even a use of synthetic fibers suitable for paper making in an amount of 10 to 30 % are covered by the aforementioned definition of the term "tissue". It is analogously possible to apply the method beyond the field of paper making to corresponding fields in the nonwoven and textile sectors.

Upon application of the treatment composition, it is possible to start out e.g. from a multiply, usually two-ply to four-ply or multiply (doubled) master roll produced in a separate doubling machine. A plurality of one-ply tissue webs can alternatively be treated (one unwinding each) and then jointly rolled up into a multiply tissue product via a roll-up device. This produces the advantage that e.g. the inner plies can be treated with a treatment chemical other than that for the outer plies. For example, the inner plies of a four-ply end product can remain untreated, or can be treated with a strength-boosting agent, whereas the two outer plies were treated with a treatment composition to improve surface softness. In principle, an extremely wide variety of combinations of differently treated tissue plies is conceivable.

In one embodiment, the tissue is a four-ply or three-ply doubled raw tissue for making handkerchiefs or facials, the tissue being made available in the form of master rolls for the application of a treatment agent in a processing machine suitable for this purpose. The processing machine comprises at least one unwinding device for the master rolls, a roll-up device for the product finished after application of a treatment agent, and an interposed applicator for applying the treatment agent.

The method according to the invention will now be explained in further detail by means of an illustration. Fig. 1 is a diagrammatic illustration of a preferred embodiment of the

application method according to the invention and of the apparatus according to the invention in which the reference numbers represent the following:

(1) belt 1
(2) belt 2
(3) tissue
(4) spray means
(5) application roller
(MD) machine direction

In Fig. 1 the treatment composition is applied to the revolving belts (1) and (2) using spray means (4) and rollers (5). The belts make contact with the tissue (3) moving in the machine direction (MD) on the side opposite the spray means and rollers. While the belts make contact with the tissue, the treatment compositions applied to the belts are transferred to the tissue.

To explain the present invention, reference is also made to the introductory portion of the specification where properties of, and production processes for, tissues are described.

Claims

1. A method of applying treatment chemicals to a fiber-based planar product, particularly tissue, said method comprising the steps of:

   a) applying a treatment composition containing the treatment chemicals to a revolving belt (1) and

   b) bringing the revolving belt (1) into contact with the moving fiber-based planar product (3), thereby transferring the treatment composition from the revolving belt (1) via the contact surface to the moving fiber-based planar product (3).

2. A method according to claim 1, wherein on the side opposite the belt (1), the moving fiber-based planar product (3) is brought into contact, via a contact surface, with a second revolving belt (2) to which a treatment composition is applied, thereby transferring the treatment composition from the revolving belt (2) via the contact surface to the fiber-based planar product.

3. A method according to at least one of claims 1 or 2, wherein the moving fiber-based planar product and the revolving belts have approximately the same speed during contact.

4. A method according to at least one of claims 1 to 3, wherein the first belt (1) and/or the second belt (2) are subjected to a cleaning stage disposed after contact with the fiber-based planar product (3) and before the application means (4, 5), relative to the direction of travel of the belt.

5. A method according to at least one of claims 1 to 4, wherein the application of the treatment composition to at least one of the belts is effected by means of spray application and/or roller application.

6. A method according to at least one of claims 1 to 5, wherein at least one belt is heated.

7. A method according to at least one of claims 1 to 6, wherein at least one belt is structured.

8. A method according to at least one of claims 1 to 7, wherein the treatment chemicals include at least one of the following constituents:
agents for skin care and protection selected from moisturizers, substituents for the skin's natural moisturizing factor (NMF), the cleavage products of collagen and/or glycerol;
skin care agents containing long-chain fatty acid esters (like sorbitan fatty acid ester or Cetiol®), lanolin or derivatives thereof;
fragrances containing natural, naturally identical or artificial perfumes; and/or
active cosmetic ingredients containing D-panthenol or the active camomile ingredient α-bisabolol or
strength-boosting agents selected from wet-strength agents containing epichlorohydrin resins or crosslinked polyalkylene amines,
agents that promote the softness (e.g. bulk softness or surface softness) of the planar product, particularly the tissue, containing a polyhydroxy compound selected from ethylene glycol, propylene glycol, a liquid polyethylene glycol (derivative), a liquid polypropylene glycol (derivative) and/or glycerol,
quaternary ammonium compounds, optionally in combination with the polyhydroxy compounds;
polysiloxanes,

surfactants containing long-chain quaternary ammonium compounds,
waxes, oils, and/or
inorganic or organic pigments or dyes.

9. A method according to at least one of claims 1 to 8, wherein the treatment composition contains additional auxiliary substances and additives.

10. A method according to at least one of claims 1 to 9, wherein the amount of applied treatment composition is 2 to 50 wt.%, relative to the fiber-based planar product (oven dried).

11. An apparatus for applying treatment chemicals to a fiber-based planar product, particularly a tissue, comprising:
at least one application means (4, 5) for applying treatment compositions containing the treatment chemicals to a revolving belt (1), and the revolving belt (1) that is in contact with moving fiber-based planar product (3) via a contact surface and transfers the applied treatment composition via this contact surface to the moving fiber-based planar product (3).

12. An apparatus according to claim 11, further comprising a second revolving belt (2) on that side of the fiber-based planar product which is opposite the belt (1), said second revolving belt being in contact with the moving fiber-based planar product via a contact surface, said apparatus further including at least one other application means (4, 5) for applying treatment compositions to the revolving belt (2), said belt (2) thereby transferring the treatment composition via the contact surface to the fiber-based planar product.

13. An apparatus according to at least one of claims 11 or 12, wherein the speed of the belts and of the fiber-based planar product is approximately equal.

14. An apparatus according to at least one of claims 11 to 13, wherein at least one application means comprises at least one spray means and/or at least one roller.

15. An apparatus according to at least one of claims 11 to 14, comprising at least one heating means for at least one of the revolving belts.

16. An apparatus according to at least one of claims 11 to 15, wherein at least one of the belts is structured.

17. A fiber-based planar product obtainable according to a method comprising the steps according to at least one of claims 1-10.

18. A fiber-based planar product according to claim 17, said product being a tissue.

19. A tissue according to claim 18, in the form of a cleaning wipe, sanitary product, paper handkerchief, household towel, hand towel, tissue for facial use, a napkin/serviette, bed linen or a garment.

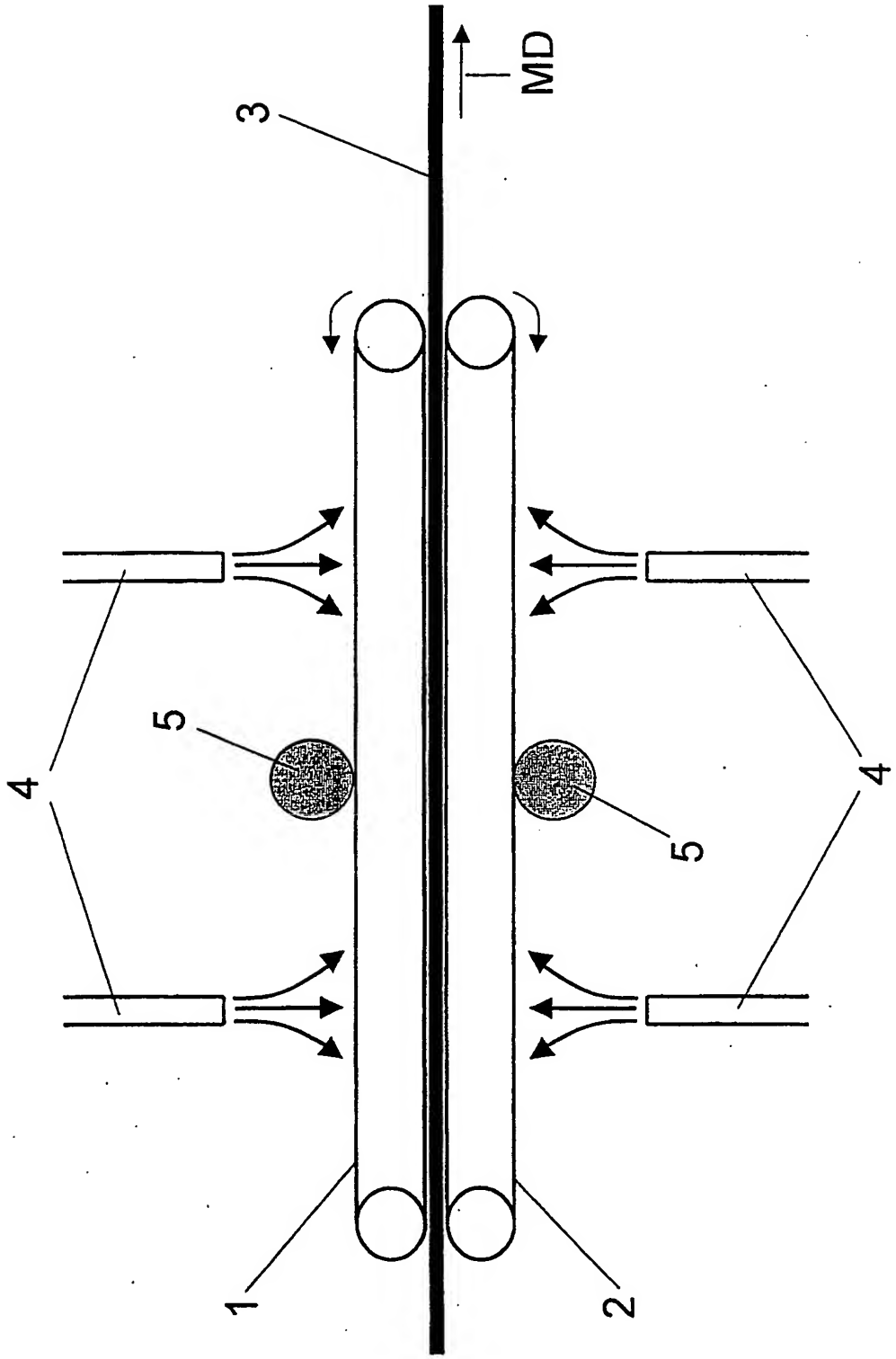

Fig. 1

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 D21H23/54

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 D21H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 578 125 A (SIEBERTH RALF) 26 November 1996 (1996-11-26) claims 1-15; figure 1 ---	1,2,8, 11,12,17
X	DE 180 269 C (DOBLER FERDINAND) 12 January 1907 (1907-01-12) page 1, line 1 -page 2, line 39; claim 1; figures 1,2 ---	1,2,8, 11,12,17
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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'X' document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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'&' document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 April 2001	19/04/2001

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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